<!--ee143, exam #2, fall/1994 -->

Problem #1

1A.(25 Points) Reslotion and Total Focus Range

Assume the large area plateaus on a chip are constrained to have a height difference of at most three times the resolution as the device is sacaled for future generations. Forn a fixed k1 and wavelength this unfortunately makes k2 increase. Find an expression for k2 as a function of k1, the wavelength and linewidth. Evaluate k2 for k1 = 0.6, lambda = 0.248 um and a linewidtha of 0.18um.

Answer: k2 = 3(k1^2)lambda/LWidth
k2 = 1.486

1B.(25 Points) Standing Waves

A substrate produces standing waves in a resist with vertical contrast Cv = 0.5. The resist has refractive index 1.68 and the substrate is to be modeled as having a real refractive index larger than that of the resist. Find the refractive index of the substrate by systematically working backward through the intensity min/max and reflection coefficient, etc.

Answer: Ns = 2.91

Problem #2

2A.(15 Points) Contacts

Do you recommend putting n+ polysilicon on contacts before depositing aluminum? Answer first and then estimate the contact resistance for a 3 um by 3 um contact with such a treatment.

Answer: Yes, this way we get poorer value of Pc but it prevents junction spiking.
No answer available for part 2.

2B.(20 Points) Carrying Signals

An aluminum film 0.5 um thick on a 0.4 um oxide is to carry a 5 mA current 1 cm. Find the width of the conductor required and the associated propagation delay.

Answer: No Answer available

<!--ee143, exam #2, fall/1994 -->

Problem #3

3A.(15 Points) Microprocessor Yield

A microprocessor chip with area 2 cm^2 has a photo yield of 80% and an overall yield of 60%. It is to be scaled from a 0.8 um linewidth to a 0.55 um linewidth with a final area of 1 cm^2. At the 0.55 um linewidth the photo defect density is 1.5 times that of the photo defects at 0.8 um. The defect density for the non-photo steps remains constant. Deteremine the yield for the scaled chip.

Answer: 73.2%

3B.(20 Points) Design of a Test Chip

A process has a random defect density of approximately 0.5 defects cm^-2. You are to specify the area of a test die to measure the defect density. For statistical purposes you are to make the number of good die equal the number of defective die and both should be approximately 400. Suggest a chip area to use, the number of wafers to run, and the fraction of the bad die with multiple defects which require more than one photo to be taken.

Answer: approx. 5 wafers, Adie = 1.39 cm^2, 15.3%

Problem #4 Etching and Depostion

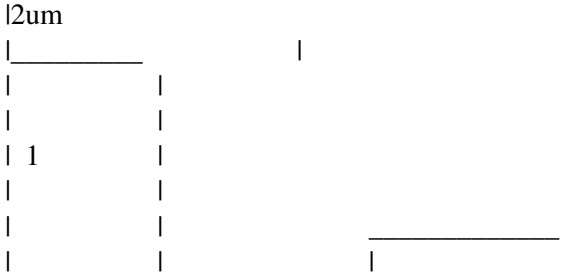
4A.(10 Points) Vacuum

A long throw l;ift-off metallization system uses a source 1m from the wafer. What is the maximum pressure which can be used such that more than 90% of the metal molecules leaving the source hit the wafer without collisions?

Answer: P = 4.11 x 10^-8 atm

4B.(20 Points) Isotropic Case

The profile below undergoes two process steps. First, an isotropic depositon of 1.0 um oxide is made. It is followed by an isotropic etchback of 1.0 um of oxide. Sketch the oxide profile at the end of depostion and after etchback. Specify the height of the oxide on the left vertical sidewall of the trench after etchback.



<!--ee143, exam #2, fall/1994 -->